Landscape Classification Measurement Process

Dec 14 2016

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Agenda

Program Objectives and Approach

Landscape Area Measurement Steps

Program Timeline

Team Members

California Landscape Classification Measurement Program Objectives

Establish standard definitions and approaches to landscape classification (LC) within California

Create accurate area measurements of residential and commercial LC properties across California

Create timely and repeatable updates (e.g., on a yearly basis) of area measurements of LC across California

Enable consistent, fair, comparable water budget calculation processes

Program Implementation Approach

Step 1: Acquire Digital Imagery

Step 2: Acquire Parcel and Other Metadata

Step 3: Run Imagery and Parcel Data Through the "Machine"

Step 4: Perform Quality Assurance and Refinement of Landcover Classification

Step 5: Generate Water Budgets

Step 6: Distribute Statistics

LC Measurement Process: Step 1 - Acquire Digital Imagery

Both OmniEarth and Eagle Aerial have high resolution databases that cover California – providing unparalleled collection frequency.

Aerial Imagery

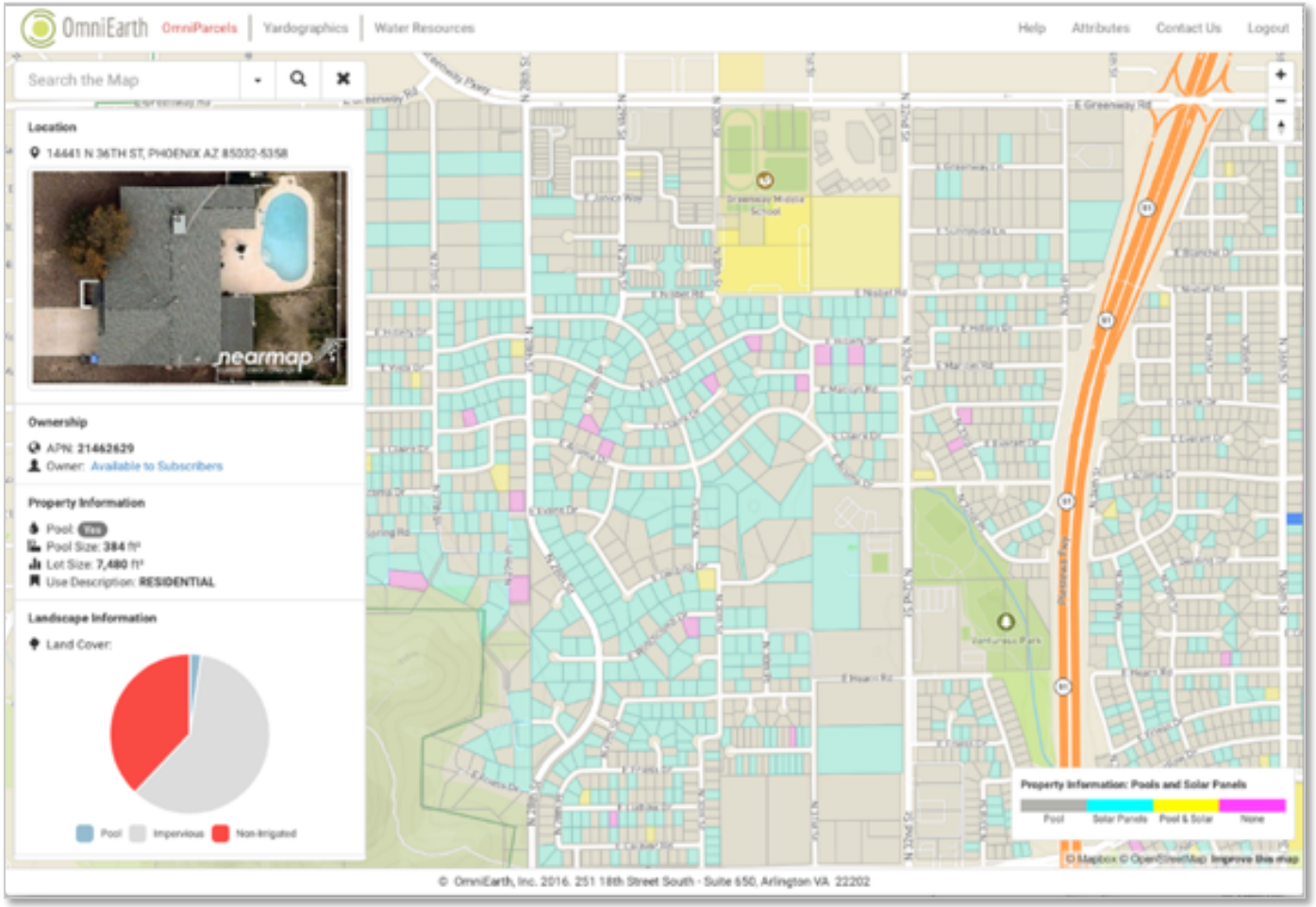
High Resolution (< 10 cm)

Multi-band (3 to 4)

Collected during late summer months

LC Measurement Process: Step 2 - Acquire Parcel and other MetaData

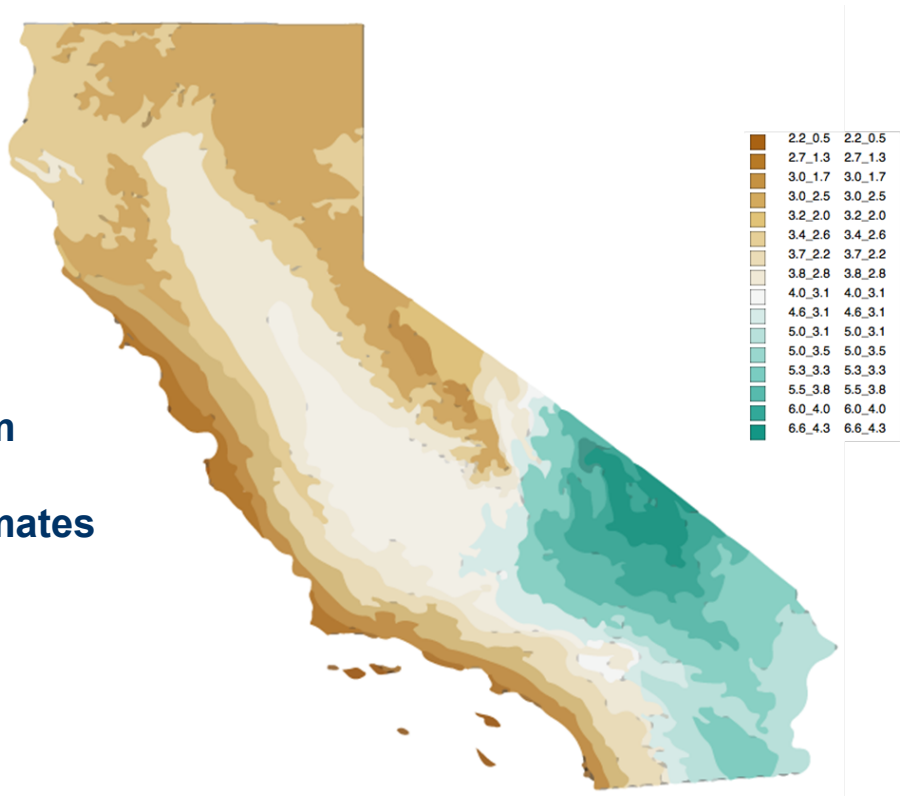
Nationwide parcel and census information are already compiled in the OmniParcel platform



LC Measurement Process: Step 2 continued

Acquire USGS 3DEP (⅓ arc-second) and/or alternative sources such as SRTM digital elevation maps (DEM) to account for terrain fluctuations and for identification of sloped areas

Pull daily ET rates from CIMIS to account for weather and micro climates



LC Measurement Process: Step 3 – Run Imagery and Parcel Data through "Machine"

Generates supervised automated land cover (highly scalable process)

Standard LC categories = Waterbodies, Turf, Tree/Shrubs, Impervious, Non-irrigated

OmniEarth Distinguishes Irrigated vs. Irrigable Area for Every Parcel

This enables agencies to compare these distinct landscape features and their corresponding water budgets, while providing a comprehensive picture of potential water demand.

LC Measurement Process: Step 4 – Refinement Process

Eagle and Quantum have refined a proprietary, professionally managed process to improve the accuracy of an automated classification. This process has been refined over years with many water agencies in California and will be applied in this project.

Separate natural and managed vegetation

Stratify the parcels within the water districts

Create highly accurate training samples with additional classes within specific strata

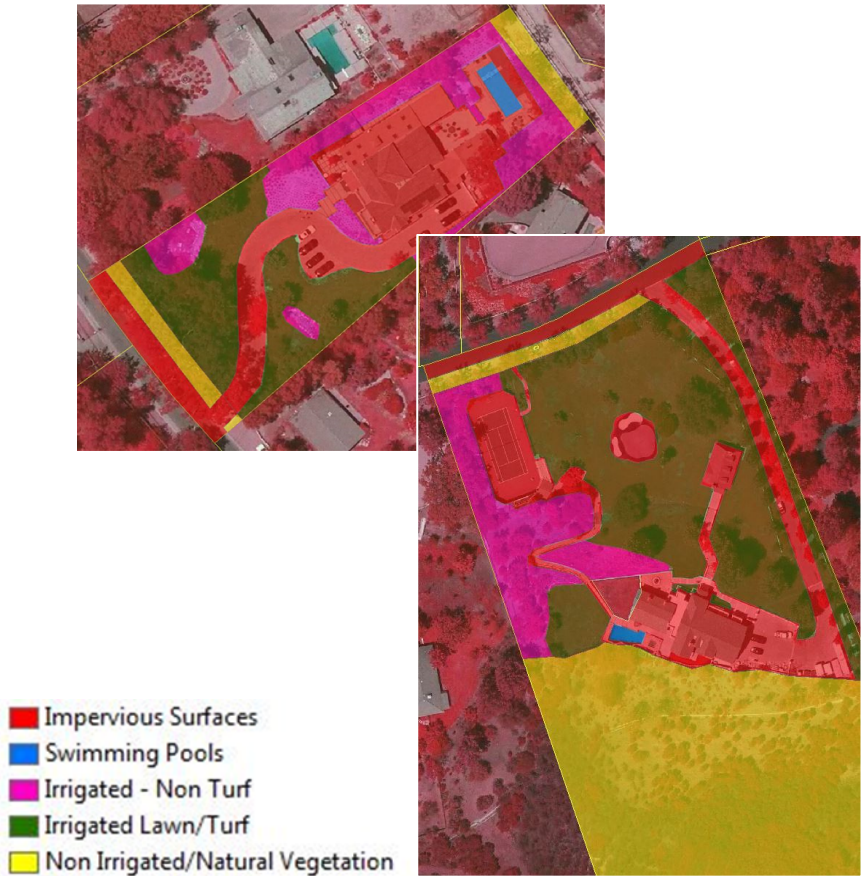
Allocate shadow/unclassified

Conduct statistically significant assessments across water district

Create estimates of irrigable and irrigated areas and uncertainty across all parcels

QC outliers

Deliver to OmniEarth for MAWA calculation



LC Measurement Process: Step 4 – Perform QA and Refinement of LC

Assessment of Accuracy and Additional Classes

Data will be provided to third party with classification scheme and error estimate for verification

Access accuracy across water district level.

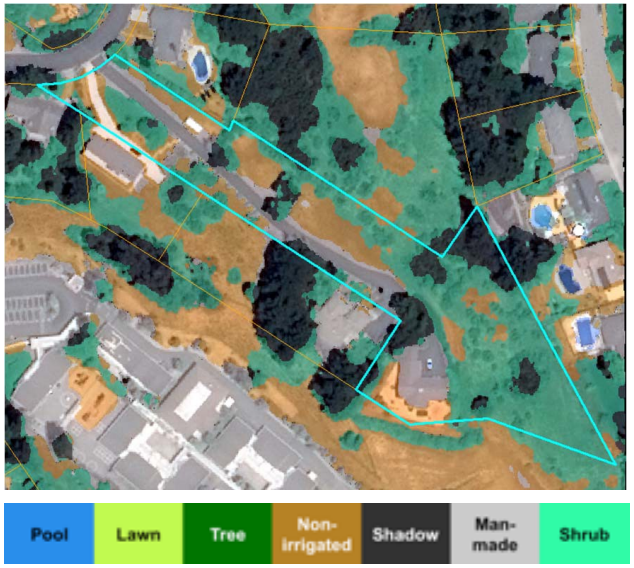
Discussion on classes

Need to maintain consistency BUT ensure local requirements are understood

- Native Vegetation
- Agriculture
- Fire Suppression
- Graded but not developed
- Curbside- Parkway
- Undefined

Challenges of Landcover Classification

Outlined parcel area provides excellent example of a challenging parcel – the landcover classification indicates turf, but it is natural grasses rather than irrigated.



Problem is solved through:

- Human land-use expertise, and
- multi-season imagery in and out of summer

LC Measurement Process: Step 5 – Generate Water Budgets: MAWA Example

Integrating vegetation cover with meteorological data (e.g., ET) generates outdoor water budgets.

For calculating the Maximum Applied Water Allowance (MAWA) the following formula is used:

MAWA = (ETo) (0.62) [(ETAF x LA) + ((1 - ETAF) x SLA)]	
MAWA	Maximum Applied Water Allowance (gallons per year)
ETo	Reference Evapotranspiration (inches per year)
0.62	Conversion Factor (converts acre-inches per acre per year to gallons per square feet per year)
ETAF	ET Adjustment Factor
LA	Landscape Area, including Special Landscape Area (sq ft)
SLA	Special Landscape Area (sq ft) *(parks, golf courses, etc.)*

Residential

Total Budget = Indoor + Outdoor

Outdoor Budget: MAWA = (ETo) (0.62) [(ETAF x LA) + ((1 - ETAF) x SLA)]

Indoor Budget: "Census Average # People in Home" * 55 GPCD * Days in Billing Cycle

ETAF = 0.8 (can be adjusted); High water hydrozones (e.g., Pools) can include an ETAF

LC Measurement Process: Step 6 – Distribute Statistics

LC and Water Budget statistics will be provided at aggregate levels for all agencies, including:

Agency ID

Overall Land Cover Statistics (sq footage by land cover class)

Land Cover Statistics by Parcel Type (SFR, CII, multifamily)

Land Cover Statistics by Parcel Size

Overall Indoor, Outdoor, and Total Water Budget (monthly)

Water Budget Statistics by Parcel Type (SFR, CII, multifamily)

12 Month to Date Water Budget

Historical Water Budget Trend (dating back to 2015)

Confidence Intervals

LC Measurement Process: Step 6 – Distribute Statistics (cont)

An external QA sample will be provided at parcel levels for all agencies, including:

APN

Property Classification (e.g., single family residential, multi-family residential, commercial)

Address

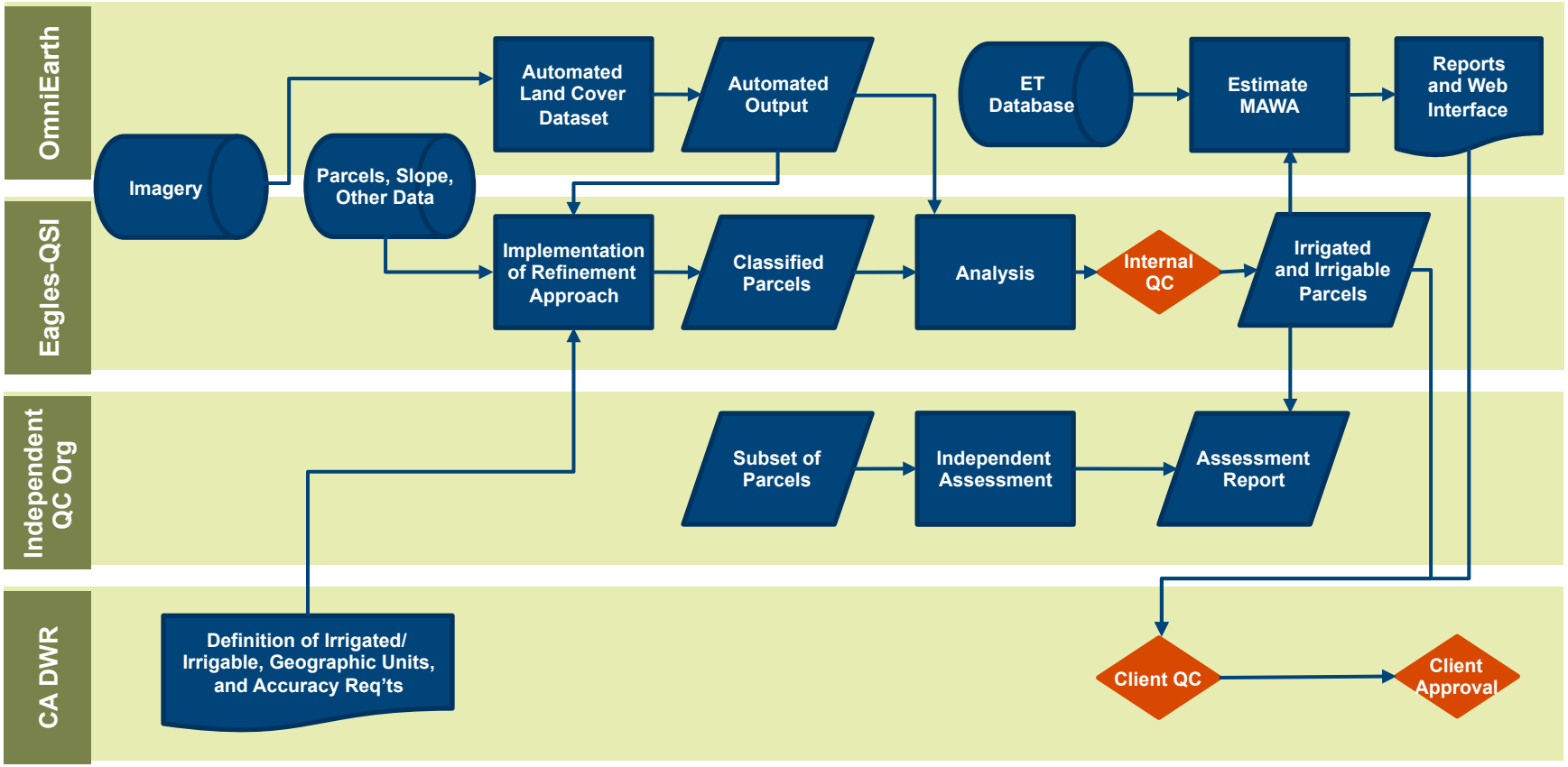
Land Classification Values, Total Land cover by area (sq. footage category)

Sq. Footage of Irrigated and Irrigable Area

Monthly Water Budget by parcel (gallons)

12 Month-to-Date Water Budget by parcel (gallons)

Overview of Process



Program Timeline

Element	#Agencies	Objectives	Duration	Deliverables
Demo	2	Establish LC standards and external QA process	2.5 months	- Agency LC summaries - Agency Water Budget summaries - Parcel sample data - Process documentation

About the Team

OmniEarth

Founded by scientists and geared toward industry, OmniEarth delivers a constant stream of geoanalytics – information derived from a number of Earth observation sources – to provide data and enhanced decision-making insights for subscribers in the public and private sectors.

In 2014, OmniEarth became the first company to specialize in automated water efficiency analysis

Company has signed agreements with 30 agencies across California, including Inland Empire Utilities Agency, Moulton Niguel Water District, East Bay Municipal District, West Valley Water District, Eastern Municipal Water District, and the Cities of Loma Linda, Rialto, Tustin, Brea, Newport Beach and Fullerton

Of ≈30 employees, 6 are PhDs (and 3 of them are assigned to DWR Pilot)

Staff has experience at some of the nation's leading Labs, including the Johns Hopkins, Draper, and NASA

Eagle Aerial / Quantum Spatial Team

Eagle Aerial is a mature company, specializing in aerial imagery and data management solutions. The company offers the highest-quality, up-to-date ortho imagery covering markets throughout the US but specializing in California.

Works closely with Quantum Spatial, a full-service geospatial firm, to execute spatial data generation, integration, and analysis

Experienced in specialized services for water agencies, such as detailed parcel-by-parcel analysis and surface classifications; customers include EBMUD, Las Virgenes, Irvine Ranch, and DWR

Leading provider of enterprise geographic information systems (EGIS), including geospatial planning and analysis, geospatial data management services, support, and cloud solutions (DaaS)

Team Members

OmniEarth

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Wayne Tate, Eagle Aerial
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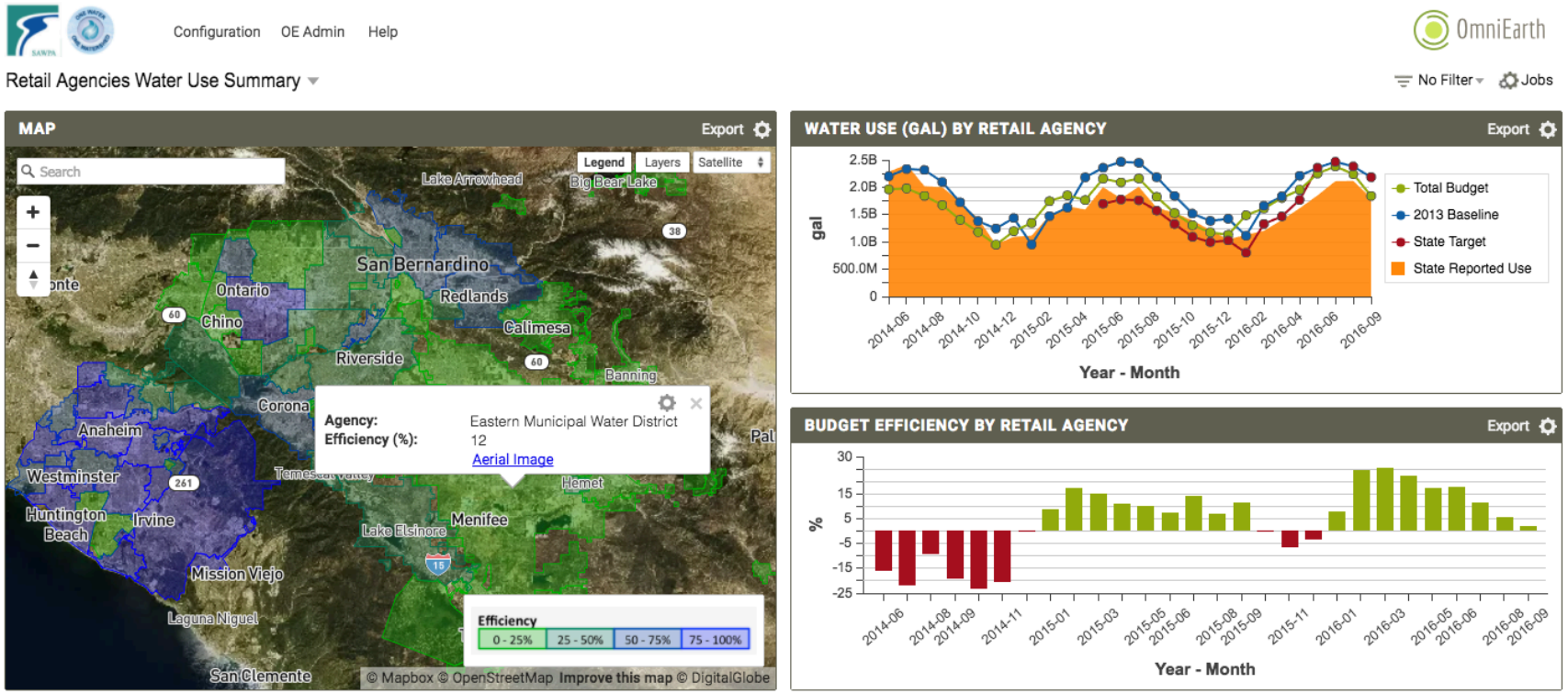
Norman Woo, Eagle Aerial
Production Manager

Backup

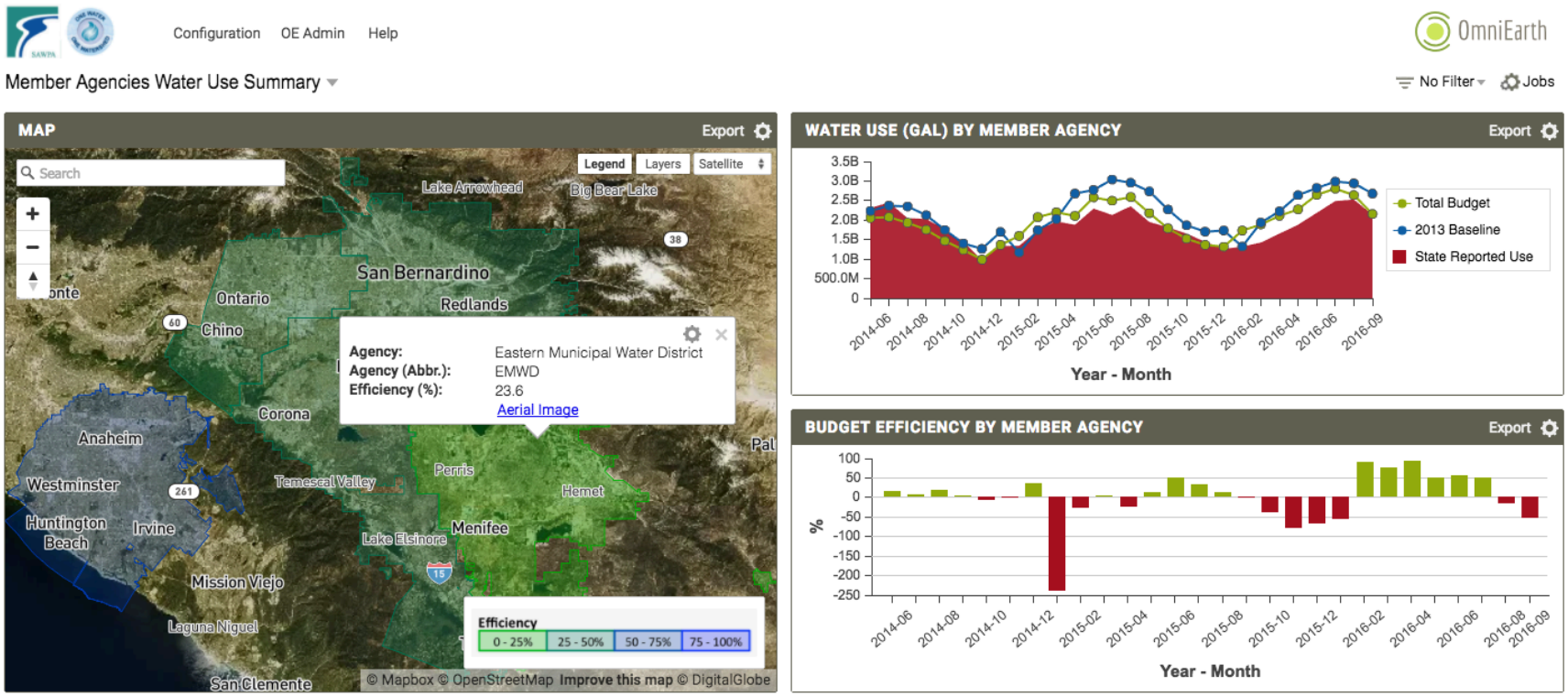
Retail Agencies Water Use Summary



WATER USE (GAL) BY RETAIL AGENCY — Columns

Agency Name	Year - Month	Indoor Budget	Outdoor Budget	Total Budget	State Reported U...	2013 Baseline	State Target	2013 Efficiency (...	Budget Efficiency...
Eastern Municipal ...	2016-09	726,955,267.2	1,113,770,672.1	1,840,725,939.3	1,804,135,079.0	2,184,397,177.0	2,184,397,177.0	17.4	2.0
Eastern Municipal ...	2016-08	726,955,267.2	1,515,290,656.4	2,242,245,923.6	2,116,343,106.6	2,381,807,747.5	2,381,807,747.5	11.1	5.6
Eastern Municipal ...	2016-07	726,955,267.2	1,655,344,796.1	2,382,300,063.3	2,111,517,246.8	2,466,613,839.8	2,466,613,839.8	14.4	11.4
Eastern Municipal ...	2016-06	726,955,267.2	1,524,036,480.5	2,250,991,747.8	1,850,666,662.6	2,357,104,950.3	2,357,104,950.3	21.5	17.8
Eastern Municipal ...	2016-05	726,955,267.2	1,225,077,997.4	1,952,033,264.7	1,615,212,938.8	2,210,465,291.6	1,768,372,233.3	26.9	17.3
Eastern Municipal ...	2016-04	726,955,267.2	1,076,092,052.9	1,803,047,320.2	1,400,639,773.6	1,834,152,512.0	1,467,322,009.6	23.6	22.3
Eastern Municipal ...	2016-03	726,955,267.2	885,530,525.1	1,612,485,792.4	1,202,522,106.4	1,660,017,509.6	1,328,014,007.7	27.6	25.4
Eastern Municipal ...	2016-02	726,955,267.2	761,734,029.6	1,488,689,296.9	1,129,128,679.2	1,112,117,886.4	800,724,878.2	-1.5	24.2

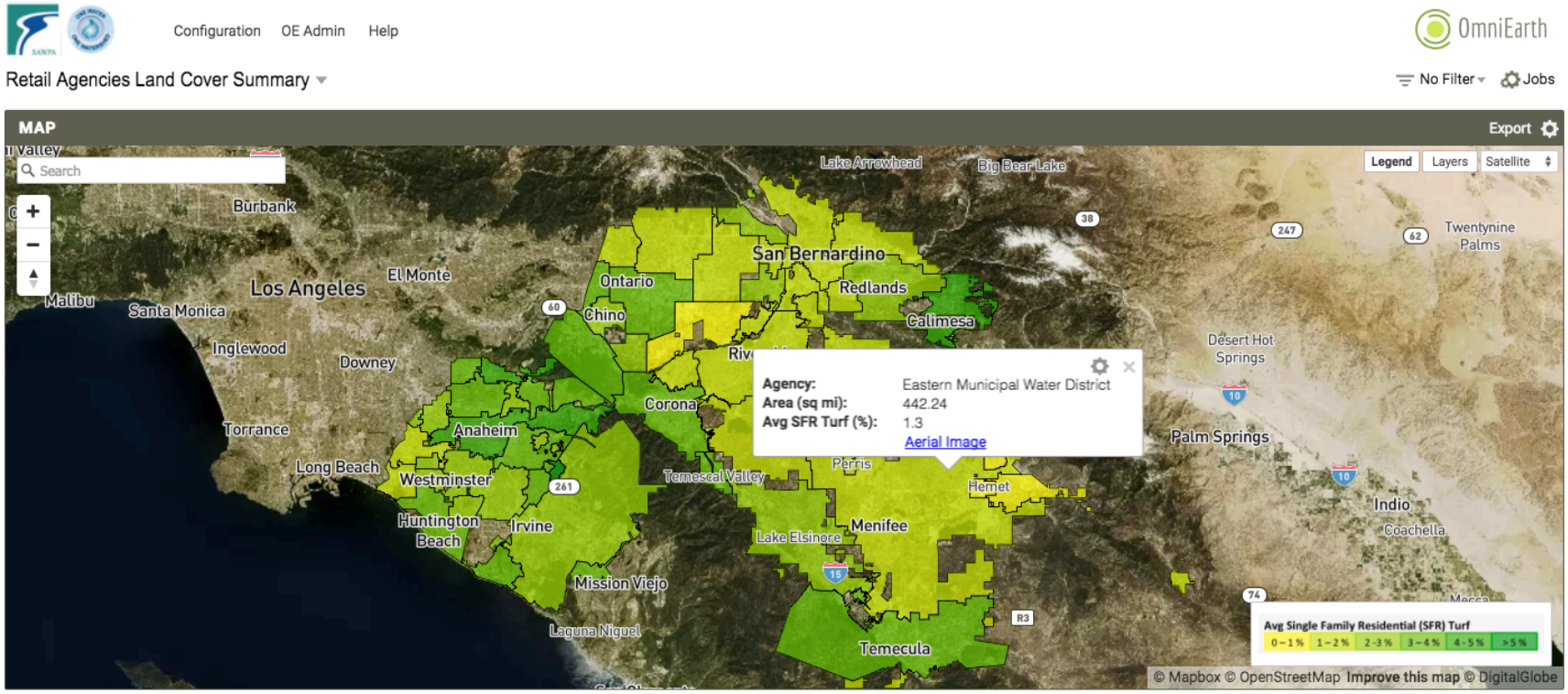
Member Agencies Water Use Summary



WATER USE (GAL) BY MEMBER AGENCY — Columns

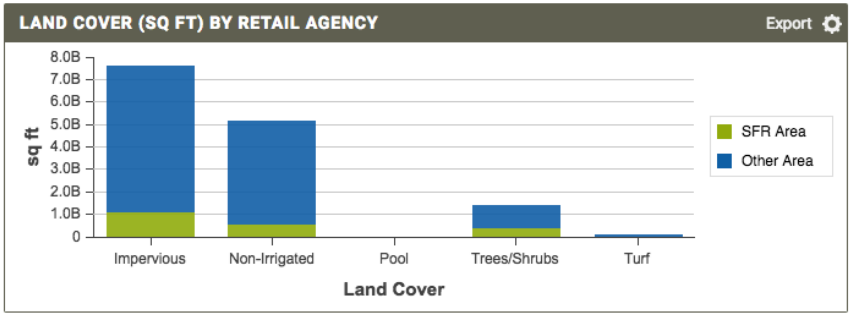
Agency	Year - Month ↓	Indoor Budget	Outdoor Budget	Total Budget	State Reported Use	2013 Baseline	2013 Efficiency (%)	Budget Efficiency (...
EMWD	2016-09	846,705,445.6	1,310,530,386.2	2,157,235,831.9	2,137,939,272.2	2,680,429,749	107.4	-55.7
EMWD	2016-08	846,705,445.6	1,793,132,003.9	2,639,837,449.5	2,526,462,327.8	2,942,510,059.1	116.6	-17.1
EMWD	2016-07	846,705,445.6	1,958,311,857.9	2,805,017,303.6	2,487,545,243.8	2,987,986,529.2	121.4	48.7
EMWD	2016-06	846,705,445.6	1,800,885,278.5	2,647,590,724.2	2,184,725,383.8	2,820,289,742.9	127.5	55.3
EMWD	2016-05	846,705,445.6	1,428,762,176.2	2,275,467,621.9	1,884,081,775.2	2,639,643,689.2	154.4	47.4
EMWD	2016-04	846,705,445.6	1,262,916,649.9	2,109,622,095.6	1,653,567,600.4	2,225,494,792.9	144.8	90.6
EMWD	2016-03	846,705,445.6	1,041,793,071.7	1,888,498,517.5	1,427,147,377.8	1,936,583,836.1	97.7	75.1
EMWD	2016-02	846,705,445.6	885,612,427.3	1,732,317,873	1,319,491,624.2	1,324,345,748.2	31.2	88.6

Retail Agencies Land Cover Summary

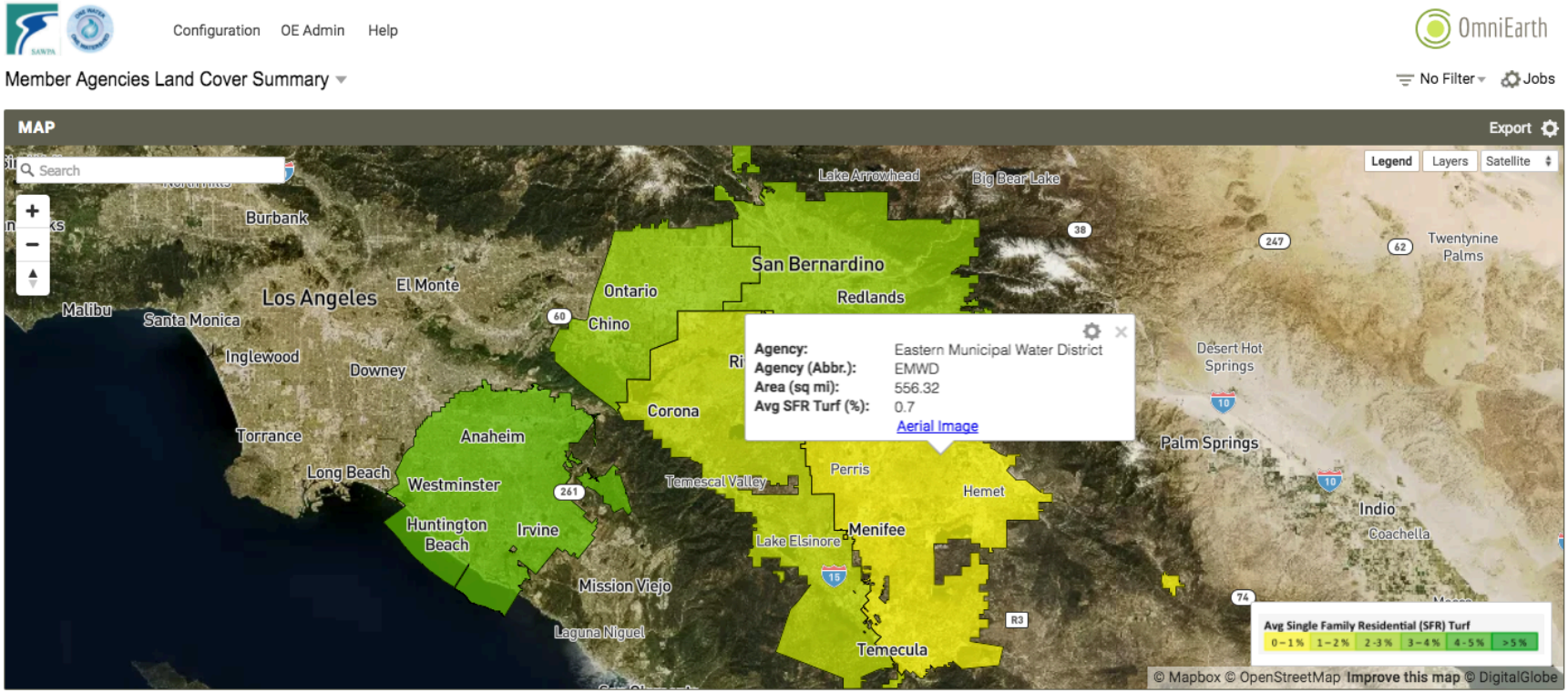


LAND COVER (SQ FT) BY RETAIL AGENCY — Columns

Agency Name	Land Cover	SFR Area	Other Area	Total Area
Eastern Municipa...	Impervious	1,063,564,802.4	6,540,009,670.4	7,603,574,472.8
Eastern Municipa...	Non-Irrigated	569,827,228.1	4,605,426,000.5	5,175,253,228.6
Eastern Municipa...	Pool	3,982,610.7	12,148,417.4	16,131,028.1
Eastern Municipa...	Trees/Shrubs	355,869,054.5	1,047,144,419.1	1,403,013,473.6
Eastern Municipa...	Turf	23,193,965.6	99,364,262.6	122,558,228.2



Member Agencies Land Cover Summary



LAND COVER (SQ FT) BY MEMBER AGENCY — Columns

Agency	Land Cover	SFR Area	Other Area	Total Area
EMWD	Impervious	1,258,084,115.3	6,969,082,857.1	8,227,166,972.4
EMWD	Non-Irrigated	673,252,118.2	4,846,524,529.9	5,519,776,648.2
EMWD	Pool	4,508,082.8	12,472,001.8	16,980,084.5
EMWD	Trees/Shrubs	429,672,983.5	1,142,615,389.9	1,572,288,373.4
EMWD	Turf	25,881,345.5	104,794,617.9	130,675,963.4